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EXAMINER

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2461

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/585,390

Applicant(s)

FURRER ET AL.

Examiner

Joey Bednash

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 November 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 November 2010 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date. _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

This action is responsive to amendments filed 29 November 2010. Claims 1-18 are pending in the application. Claims 2, 4, 6, 8, 9, 11, 12, 14, 16 and 17 are amended.

Claim Objections

1. Claim 12 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 9, from which claim 12 depends, indicates the IDFT means generates complex output symbols $z(n)$. The inclusion in claim 12 that complex symbols $z(n) = x(n) + j \cdot y(n)$ does not impose any additional meaningful limit on claim 9 from which claim 12 depends.

Claim 9 indicates that the symbols $z(n)$ are complex symbols. It is a mathematical truism that a complex value, Z for example, can be written in the form $Z = X + j \cdot Y$. In other words, the definition in claim 9 that values of $z(n)$ are complex symbols already defines the fact that $z(n)$ can be written as $x(n) + j \cdot y(n)$. A complex number has a real and an imaginary part wherein the real part is a real number and the imaginary part is a real number multiplied by the square root of negative 1 (i.e. "j" which represents the square root of negative 1). The claim does not further define any use of $x(n) + j \cdot y(n)$, and therefore does not further limit that which was already claimed in claim 9.

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claim 8 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claim 8 is directed towards a computer program storage device. Applicant's disclosure has not described the storage device. Absent such disclosure, it is reasonable to interpret the storage device to include transitory embodiments, such as a signal. Therefore the claim is directed as encompassing non-statutory subject matter. Applicant is advised to use the term "non-transitory" with regards to the storage device in order to limit the claim to a statutory embodiment.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 2 and 11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 lacks clarity because the functional steps claimed are performed in claim 1 from which claim 2 depends. Claim 1 includes a limitation of transforming $F(k)$ to $Z(k)$ utilizing the equation of claim 1, while claim 2 includes converting $F(k)$ to $Z(k)$ using the symmetry property of spectra of real sequences. It is unclear how the method is performed because the claim includes converting and transforming $F(k)$ to $Z(k)$. It appears the limitation of converting in claim 2 is a broader description of that which is achieved by the claimed transforming of claim 1 because the specification describes the use of the symmetry property of real sequences in the derivation of the equation of claim 1 (**Publication of instant application US 2009/0323510 A1, Para [0045]-[0052]**). It is also unclear how $F(k)$ relates to $X(k)$, $Y(k)$ and $x(n)$ and $y(n)$.

Claim 11 is directed towards the means for performing the method of claim 2, and contains the same lack of clarity issues.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fertner et al. (U.S. Patent No. 5,987,005), hereinafter referred to as "Fertner".

Regarding claim 1, Fertner discloses a method for modulating sub-carrier symbols $F(k)$ to an intermediate-frequency OFDM signal ($f(n)$) having even and odd samples, the method comprising the steps of:

transforming a number N of the sub-carrier symbols $F(k)$ to pre-processed sub-carrier symbols $Z(k)$ according to the function:

$$Z(k) = \frac{1}{2} \cdot [F(k) + F(N-k)^*] + \frac{1}{2} \cdot j \cdot [F(k) - F(N-k)^*] \cdot e^{j\pi k/N}$$

with $k=0 \dots N-1$ (**Fig. 4, Extraction Block & Fig. 5, Preparation Block 46, Col. 8, lines 18-26 indicate the preparation block 46 performs the same function of the Extraction Block 42 of Fig. 4; Col. 7, line 62- Col. 8, line 17 describe the function of the Extraction Block 42; Col 5, Equations 9, 10, 11, 13 and last line of Col. 5**);

performing a complex inverse discrete Fourier transformation (IDFT) on the pre-processed sub-carrier symbols $Z(k)$ to generate complex output symbols $z(n)$ (**Fig. 5, N-Point FFT 48 and Complex Conjugators 44 and 50; Col. 7, lines 24-39; Col. 4, lines 44-64 and equation (3)**); and

transforming the complex output symbols $z(n)$ to the intermediate-frequency OFDM signal ($f(n)$), by multiplexing the real and imaginary parts of the complex output symbols $z(n)$ into even and odd samples of the intermediate frequency OFDM signal ($f(n)$) (**Fig. 5, Complex to Real Expander 52; Col. 7, lines 39-47; Col. 8, lines 43-49**).

Fertner teaches a method which uses an N -point discrete Fourier Transform (DFT) to calculate the DFT of a $2N$ -point real valued sequence utilizing the transformation described by equations 13 which differs slightly from applicant's claimed equation. However, Fertner teaches equation 14 (i.e. the claimed equation) is redundant

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information and opts to utilize equation 13 to perform the claimed transformation (**Col. 6, lines 1-10**). It would have been obvious to one of ordinary skill in the art that using equation 14 as the N-point input to the DFT would achieve the same result as that produced by utilizing equation 13 because Fertner teaches the equations are redundant and thus equivalent.

Regarding claim 2, Fertner fairly suggests the method according to claim 1 further comprising the steps of:

assigning the sub-carrier symbols $F(k)$ to a spectrum $F(i)$ with $i=0\dots 2N-1$ of the intermediate-frequency OFDM signal ($f(n)$) (**Col. 3, line 58 – Col 4, line 11**), negative frequency contents being derivable from the symmetry property of spectra of real sequences, $F(i)=F(2N-i)^*$ (**Col. 6, lines 10-64**);

converting the sub-carrier symbols $F(k)$ (**i.e. $x_B(k)$**), with $k=0\dots N-1$, to the pre-processed complex sub-carrier symbols $Z(k)$ (**i.e. $X(k)$, equation 14**) using the symmetry property of spectra of real sequences, wherein $Z(k)=X(k)+j\cdot Y(k)$ (**$X_C(k)$, equation 5**) with $X(k)$ (**$X_1(k)$, equation 9**) and $Y(k)$ (**$X_2(k)$, equation 10**) defining the spectra of real sequences $x(n)$ (**$x_1(n)$, equation 6**) and $y(n)$ (**$x_2(n)$, equation 7**) (**Col. 5, line 6- Col. 6, line 10; Col. 7, line 62- Col. 8, line 26**); and

performing the complex inverse discrete Fourier transformation (IDFT) of the pre-processed complex sub-carrier symbols $Z(k)$ into the complex output symbols $z(n)=x(n)+j\cdot y(n)$ (**equation 4**) (**Fig. 5, N-Point FFT 48 and Complex Conjugators 44 and 50**); **Col. 7, lines 24-39; Col. 4, lines 44-64 and equation (3)**).

Note: The limitation “negative frequency contents being derivable from the symmetry property of spectra of real sequences, $F(i)=F(2N-i)^*$ ” is a statement of intended use or field of use. Such language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation (MPEP 2111.04).

Regarding claim 3, Fertner fairly suggests the method according to claim 1, wherein the complex inverse discrete Fourier transformation (IDFT) is performed as an inverse fast Fourier transformation (IFFT) (**Col. 4, lines 44-64, N-point FFT; Fig. 5, N-Point FFT 48**).

Regarding claim 4, Fertner teaches a method for demodulating an intermediate-frequency OFDM signal ($f(n)$) having even and odd samples to post-processed sub-carrier symbols $F(k)$, the method comprising the steps of:

transforming the intermediate-frequency OFDM signal ($f(n)$) to complex input symbols $z(n)$, by demultiplexing the even and odd samples of the intermediate-frequency OFDM signal ($f(n)$) onto the real and imaginary parts of the complex input symbols $z(n)=x(n)+j\cdot y(n)$ with $x(n)=f(2n)$ and $y(n)=f(2n+1)$ with $n=0\dots N-1$ (**Fig. 4, real-to-complex compressor 38; Col. 7, lines 48-54**);

performing a complex discrete Fourier transformation (DFT) on the complex input symbols $z(n)$ to generate complex DFT output symbols $Z(k)$ (**Fig. 4, N-point FFT 40; Col. 7, lines 58-61; Col. 4, lines 29-31**); and

transforming the complex DFT output symbols $Z(k)$ to the post-processed sub-carrier symbols $F(k)$ according to the function:

$$F(k) = \frac{1}{2} [Z(k) + Z(N-k)^*] - \frac{1}{2} j [Z(k) - Z(N-k)^*] \cdot e^{-j\pi k/N}$$

with $k=0 \dots N-1$ (**Fig. 4, Extraction Block 42, ; Col. 7, line 62- Col. 8, line 17 describe the function of the Extraction Block 42; Col 5, Equations 9, 10, 11, 13 and last line of Col. 5).**

Fertner teaches a method which uses an N-point discrete Fourier Transform (DFT) to calculate the DFT of a 2N-point real valued sequence utilizing the transformation described by equations 13 which differs slightly from applicant's claimed equation. However, Fertner teaches equation 14 (i.e. the claimed equation) is redundant information and opts to utilize equation 13 to perform the claimed transformation (**Col. 6, lines 1-10**). It would have been obvious to one of ordinary skill in the art that using equation 14 as the N-point input to the DFT would achieve the same result as that produced by utilizing equation 13 because Fertner teaches the equations are redundant and thus equivalent.

Regarding claim 5, Fertner fairly suggests the method according to claim 4, wherein the complex discrete Fourier transformation (DFT) is performed as a fast Fourier transformation (FFT) (**Fig. 4, N-point FFT 40; Col. 7, lines 58-61; Col. 4, lines 29-31**).

Regarding claim 6, Fertner fairly suggests the method according to claim 4, further comprising the steps of:

performing the complex discrete Fourier transformation (DFT) of the complex input symbols $z(n)$ into the complex DFT output symbols $Z(k)=X(k)+j\cdot Y(k)$ with $k=0\dots N-1$, $X(k)$ and $Y(k)$ being the spectra of the real sequences $x(n)$ and $y(n)$ (**Col. 7, lines 58-61**);

post-processing of the complex DFT output symbols $Z(k)$ with $k=1\dots N-1$ to the post-processed sub-carrier symbols $F(k)=X(k)+e^{-j\pi k/N}\cdot y(k)$ of the intermediate-frequency OFDM signal ($f(n)$) (**Fig. 9; Col. 10, lines 35-44**); and

assigning the post-processed sub-carrier symbols $F(k)$ to an order for further processing (**Fig. 9, Symbol Decoder 186 to further processing**).

Regarding claim 7, Fertner teaches a computer program element comprising program code means for performing the method of claim 1 (**see rejection of claim 1 above**) when said program is run on a computer (**Col. 8, lines 50-63**).

Regarding claim 8, Fertner discloses a computer program product stored on a computer usable medium, comprising computer readable program means for causing a computer to perform the method according to claim 1 (**See rejection of claim 1 above; Col. 8, lines 50-63**).

Regarding claims 9-11, the claims are directed towards the means for performing the method of claims 1, 3 and 2 respectively, and as such are rejected on the same grounds presented for claims 1, 3 and 2 respectively.

Regarding claim 12, Fertner fairly suggests the orthogonal frequency division multiplex modulator according to claim 9, wherein the IDFT means is adapted to perform the complex inverse discrete Fourier transformation (IDFT) of the pre-processed complex sub-carrier symbols $Z(k)$ into the complex output symbols where $z(n)$ $z(n) = x(n) + j \cdot y(n)$ (**Fig. 5, N-Point FFT 48 and Complex Conjugators 44 and 50; Col. 7, lines 24-39; Col. 4, lines 44-64 and equation (3)**).

Regarding claim 13, Fertner fairly suggests the orthogonal frequency division multiplex modulator according to claim 9, wherein the first transforming means and the IDFT means are integrated into one device (**Fig. 6; Col. 8, lines 50-63; Col. 9, lines 16-24**).

Regarding claims 14-17, claim 14 is the means for performing the method of claim 4, claim 15 is the means for performing the method of claim 5 and claims 16 and 17 contain means for performing the method of claim 6, therefore claims 14-17 are rejected on the grounds presented above with respect to claims 4-6.

Regarding claim 18, Fertner fairly suggests the orthogonal frequency division multiplex demodulator according to claim 14, wherein the DFT means and the second transforming means are integrated in one device (**Fig. 6; Col. 8, lines 50-63; Col. 9, lines 16-24**).

Response to Arguments

The replacement sheet for Fig. 1 including a "Prior Art" label has overcome the objection to the drawings presented in the previous office action.

The amendments to the claims to use mathematical symbols consistently throughout the claims has overcome the objection to claims 1, 2, 4, 6, 9, 11, 12, 14, 16 and 17 which was raised in the previous office action in regards to consistent use of symbols.

Applicant's arguments filed 29 November 2010 have been fully considered but they are not persuasive.

Examiner maintains the objection to claim 12 for failing to further limit the claim. As indicated above, a complex number Z by definition can be represented as $X + j \cdot Y$. The claim merely states a mathematical fact that $z(n)$ can be expressed as $x(n) + j \cdot y(n)$ and does not perform any steps or functions with $x(n)$ and $y(n)$; therefore, claim 12 does not further limit claim 9.

With regard to claim 2, it is examiner's position that claim 2 lacks clarity. Claim 1 transforms $F(k)$ to $Z(k)$ according to the equation presented in claim 1. Claim 2 states that $F(k)$ is converted to $Z(k)$ using the symmetry property of real sequences and gives

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a different equation for $Z(k)$, namely $Z(k) = X(k) + j \cdot Y(k)$. It is not clear if the equation for $Z(k)$ of claim 1 is a conversion which uses the symmetry property of real sequences or is the converting as claimed in claim 2 is a different step from the step of transforming $F(k)$ into $Z(k)$. Claim 1 also includes a step of performing a complex inverse discrete Fourier transform on $Z(k)$ to produce complex output symbols $z(n)$. It is not clear if this is in addition to the similar step of claim 1. While it is clear in claim 1 that $F(k)$ is transformed to $Z(k)$, $Z(k)$ is inverse discrete Fourier transformed to $z(n)$ and $z(n)$ is mapped transformed to $f(n)$, the limitation in claim 2 of assigning $F(k)$ to a spectrum $F(i)$ of the intermediate-frequency OFDM signal $f(n)$ is what the steps of claim 1 perform. Thus it is examiner's position that the steps of claim 2 are a broader version of the steps of claim 1, thus rendering the claim unclear.

The arguments regarding the prior art rejection of claims 1-18 as obvious over Fertner et al., hereafter "Fertner," amount to assertions without evidence. Applicant has repeatedly asserted the art does not teach the claimed limitations, without providing evidence to show a distinction between the art and the claimed invention. Arguments without evidence are not persuasive.

Examiner relies on the teaching found in Fertner related to the complex to real expansion that is performed in the modulator to teach the limitation of multiplexing the real and imaginary parts of the complex symbols output from the discrete Fourier transform of the intermediate frequency OFDM signal (**Fig. 5, Complex to Real Expander 52; Col. 7, lines 39-47; Col. 8, lines 43-49**). Specifically, that an N point complex sequence $x_1(n) + jx_2(n)$ (i.e. a complex number written in rectangular form where

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$x_1(n)$ is the real part of the complex number and $x_2(n)$ is the imaginary part of the complex number) is expanded into a $2N$ -point real sequence with sequential real values of $x_1(n)$, $x_2(n)$. In other words, the complex to real expander takes the real and imaginary portions of the complex number output from the inverse discrete Fourier transform and multiplexes them into even and odd samples (i.e. creates a sequence of real samples from the real and imaginary portions by alternating the real portion and the imaginary portion and removing the square root of negative 1 "j"). The portion of Fertner (**Col. 5, lines 9-11 and 23-36**) pointed to in applicants arguments is a discussion related to performing a discrete Fourier transform, while the portion of the claim and the cited portion of Fertner is a function which occurs after the inverse discrete Fourier transform on the complex symbols that result from the inverse discrete Fourier transform.

Examiner has cited specific equations found in Fertner et al. which disclose the claimed equation. Fertner discloses the following equations:

$$X_1(k) = 1/2[X_c(k) + X_c^*(N-k)] \quad \text{(Col. 5 Equation 9)}$$

$$X_2(k) = -j/2[X_c(k) - X_c^*(N-k)] \quad \text{(Col. 5 Equation 10)}$$

$$X(k) = X_1(k) + W_{2N}^k X_2(k), \quad k=0,1,\dots,N-1 \quad \text{(Col. 5 Equation 13)}$$

$$\text{Where } W_{2N}^k = e^{-j2\pi k/2N} \quad \text{(Col. 5 last line)}$$

While it would be readily apparent to one of ordinary skill in the art that these equations can be re-written in the form of the claimed equation, to address the assertion by applicants that these equations do not disclose the claimed equation as indicated in the arguments, examiner will illustrate how these are the same equations.

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Substituting the values for $X_1(k)$, $X_2(k)$ and W_{2N}^k into equation 13 of Fertner yields:

$$X(k) = 1/2[X_c(k) + X_c^*(N-k)] + e^{-j2\pi k/2N} (-j/2[X_c(k) - X_c^*(N-k)])$$

Since the second term of the equation is a multiplication of $e^{-j2\pi k/2N}$ and $-j/2[X_c(k) - X_c^*(N-k)]$, this term may be rewritten as:

$$X(k) = 1/2[X_c(k) + X_c^*(N-k)] + (-j/2[X_c(k) - X_c^*(N-k)])e^{-j2\pi k/2N}$$

Which is equivalent to:

$$X(k) = 1/2[X_c(k) + X_c^*(N-k)] - j/2[X_c(k) - X_c^*(N-k)]e^{-j2\pi k/2N}$$

In comparison to applicant's equation the $X(k)$ of Fertner would correspond to the claimed $Z(k)$ and $X_c(k)$ would correspond to $F(k)$. Fertner uses the asterix to indicate the complex conjugate of a term, thus $X_c^*(N-k)$ corresponds to applicant's representation of a complex conjugate $F(N-k)^*$. Also, $e^{-j2\pi k/2N}$ reduces to $e^{-j\pi k/N}$ since the number 2 in the numerator and denominator of the exponent cancel each other.

Comparing the equation disclosed by Fertner after rewriting the equations disclosed by Fertner with the claimed equation is presented here for ease of comparison:

$$X(k) = 1/2[X_c(k) + X_c^*(N-k)] - j/2[X_c(k) - X_c^*(N-k)]e^{-j\pi k/N}$$

$$Z(k) = 1/2[F(k) + F(N-k)^*] + j/2[F(k) - F(N-k)^*] \cdot e^{-j\pi k/N}$$

It can be seen that this equation differs slightly from the claimed equation in that the imaginary portion of the equation derived from equation 13 of Fertner is subtracted, as opposed to the addition of the claimed equation. Examiner note this in the rejection of the claim and points to equation 14 of Fertner (**Col. 5, equation 14**) in which Fertner

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describes $X(k+N) = X_1(k) - W_{2N}^k X_2(k)$, $k=0,1,\dots,N-1$. If rewrite the equivalent equation utilizing equations 9, 10 and 14 as follows:

$$X_1(k) = 1/2[X_c(k) + X_c^*(N-k)] \quad (\text{Col. 5 Equation 9})$$

$$X_2(k) = -j/2[X_c(k) - X_c^*(N-k)] \quad (\text{Col. 5 Equation 10})$$

$$X(k+N) = X_1(k) + W_{2N}^k X_2(k), \quad k=0,1,\dots,N-1 \quad (\text{Col. 5 Equation 14})$$

$$\text{Where } W_{2N}^k = e^{-j2\pi k/2N} \quad (\text{Col. 5 last line})$$

Substituting the values for $X_1(k)$, $X_2(k)$ and W_{2N}^k into equation 13 of Fertner yields:

$$X(k+N) = 1/2[X_c(k) + X_c^*(N-k)] - e^{-j2\pi k/2N} (-j/2[X_c(k) - X_c^*(N-k)])$$

Since the second term of the equation is a multiplication of $e^{-j2\pi k/2N}$ and $-j/2[X_c(k) - X_c^*(N-k)]$, this term may be rewritten as:

$$X(k+N) = 1/2[X_c(k) + X_c^*(N-k)] - (-j/2[X_c(k) - X_c^*(N-k)])e^{-j2\pi k/2N}$$

Which is equivalent to:

$$X(k+N) = 1/2[X_c(k) + X_c^*(N-k)] + j/2[X_c(k) - X_c^*(N-k)]e^{-j2\pi k/2N}$$

Comparing the equation disclosed by Fertner after rewriting the equations disclosed by Fertner with the claimed equation is presented here for ease of comparison:

$$X(k+N) = 1/2[X_c(k) + X_c^*(N-k)] + j/2[X_c(k) - X_c^*(N-k)]e^{-j\pi k/N}$$

$$Z(k) = 1/2[F(k) + F(N-k)^*] + j/2[F(k) - F(N-k)^*]e^{-j\pi k/N}$$

As can be seen this equation corresponds to the claimed equation. As indicated in the rejection of the claims, Fertner indicates the information of equation 14 is redundant and thus Fertner opts to use equation 13 to perform the transformation. It

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would have been obvious to one of ordinary skill in the art that equation 14 could be used to achieve the same purpose as equation 13 because the teaching lies in Fertner that the equations are redundant and thus equivalent to one another.

As indicated in the grounds of rejection as related to the claimed equation, examiner has pointed to portions of Fertner (**Fig. 4, Extraction Block & Fig. 5, Preparation Block 46, Col. 8, lines 18-26 indicate the preparation block 46 performs the same function of the Extraction Block 42 of Fig. 4; Col. 7, line 62-Col. 8, line 17 describe the function of the Extraction Block 42; Col 5, Equations 9, 10, 11, 13 and last line of Col. 5**). It would be readily apparent to one of ordinary skill in the art from reading these passages that the Extraction Block 42 and Preparation Block 46 exist in the demodulator and modulator of Fertner respectively. The cited portions of the reference disclose that it is these blocks which perform the claimed transformation of $F(k)$ to $Z(k)$. While Fertner goes into details about the equations as they relate to the extraction block of the demodulator, Fertner indicates that the function performed in Preparation Block 46 is the same as the function performed in Extraction Block 42. Thus the teaching can be found in Fertner of performing the transformation from $F(k)$ to $Z(k)$ according to the disclosed equations occurs in Preparation Block 46 of Fertner as would be readily apparent to one of ordinary skill in the art.

Accordingly, the assertion that Fertner does not perform a complex inverse discrete Fourier transform on the preprocessed sub-carrier symbols $Z(k)$ is not a persuasive argument because as it can be seen from the portions of Fertner relied upon for the rejection of the claim, Fertner discloses the claimed pre-processing which occurs

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in Preparation Block 46. As admitted by applicant, Fertner performs an inverse discrete Fourier transform (IDFT). And as shown in the rejection, Fertner teaches that the same circuitry which is used to perform a discrete Fourier transform (DFT) can be used to determine an IDFT. Fertner discloses an equation (**Col. 4, equation 3**) which shows that by performing a complex conjugate operation, followed by a DFT operation and then performing the complex conjugate operation on the output of the DFT, the result is an IDFT. Examiner has pointed to relevant teachings in Fertner which describe the demodulator of Fig. 5 (**Col. 7, lines 24-39**). As can be seen in Fig. 5, the preparation block is preceded by complex conjugator 44 and followed by N-Point FFT 48 which is followed by complex conjugator 50. These three items work together to perform the inverse FFT operation.

As can be seen from the discussion presented above and in Fertner (**Col. 7, lines 24-39**) the function of the Preparation Block 46 performs a transformation which is an obvious variant of the claimed equation. The advantage taught by Fertner of said preparation block is:

"The preparation process manipulates the complex conjugated input to the N-point FFT block 48 to preserve Hermite symmetry for the reasons explained earlier. Advantageously, this manipulation assures Hermite symmetry without the need to expand the sequence to 2N points which would require a 2N-point FFT rather than an N-point FFT." (**Col. 7, lines 24-30**)

"In this way, both the DFT and IDFT operations can be efficiently and economically performed." (**Col. 7, lines 35-36**)

Thus it can be seen that the preparation process performed in the preparation block is done so to allow a smaller sized FFT and DFT operations while maintaining Hermite symmetry.

Therefore it remains examiner's position that the teachings found in Fertner fairly suggest applicant's invention.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joey Bednash whose telephone number is (571)270-7500. The examiner can normally be reached on Mon-Fri 9:00 AM to 5:30 PM EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy Vu can be reached on (571)272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Joey Bednash/
Examiner, Art Unit 2461

/Jason E Mattis/
Primary Examiner, Art Unit 2461